

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
12 July 2001 (12.07.2001)

PCT

(10) International Publication Number  
**WO 01/50711 A1**

(51) International Patent Classification<sup>7</sup>:  
H04L 29/12, 12/44

(74) Agent: **GOLDEN, Larry, I.**: General Patent Counsel,  
Square D Company, 1415 South Roselle Road, Palatine, IL  
60067 (US).

(21) International Application Number: PCT/US00/33188

(81) Designated States (*national*): CA, MX.

(22) International Filing Date: 7 December 2000 (07.12.2000)

(84) Designated States (*regional*): European patent (AT, BE,  
CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC,  
NL, PT, SE, TR).

(25) Filing Language: English

(26) Publication Language: English

Published:

— With international search report.

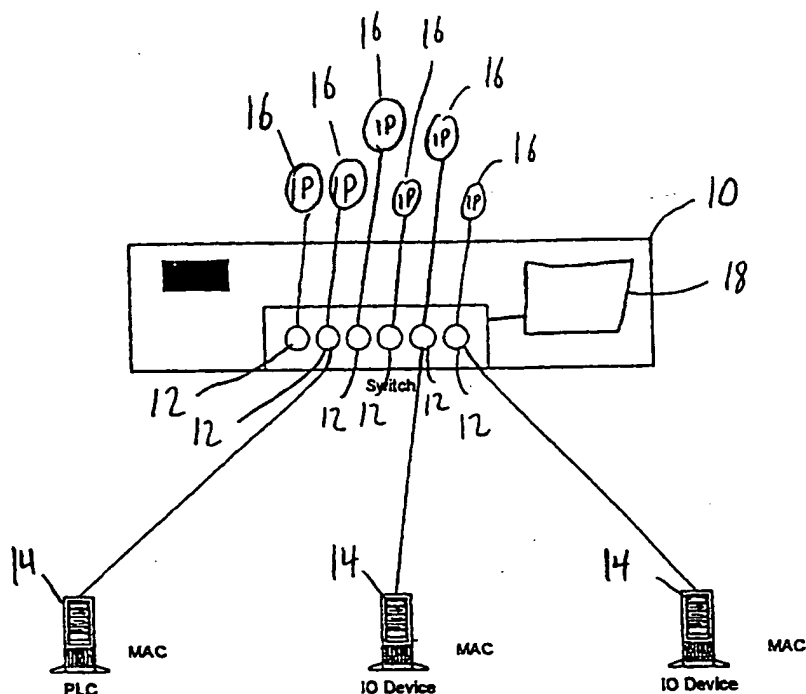
(30) Priority Data:  
09/476,052 31 December 1999 (31.12.1999) US

For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(71) Applicant: **SCHNEIDER AUTOMATION INC.**  
[US/US]; One High Street, North Andover, MA 01845  
(US).

(72) Inventors: **BAKER, Richard, A.**; 288 Middle Street,  
West Newbury, MA 01985 (US). **DUBE, Dennis, J., W.**;  
8 Birch Lane, Pelham, NH 03076 (US).

(54) Title: NETWORK ADDRESSING BASED ON THE PORT OF A NETWORK SWITCH



(57) Abstract: The present invention discloses a network switch for a computer network which receives a network message from a network device and forwards the network message to an appropriate destination. The network switch has a plurality of ports for receiving and forwarding the network message. The network switch has a logical address server which assigns a logical address to a network device based upon the port of the network switch to which the network device is connected.

**BEST AVAILABLE COPY**



WO 01/50711 A1

## NETWORK ADDRESSING BASED ON THE PORT OF A NETWORK SWITCH

### Technical Field

This invention relates to a networking addressing system which provides logical addresses to network devices based on the port of a network switch to which the network device is connected.

5

### Background of the Invention

Referring to Figure 1, commonly a Media Access Control (MAC) address 2 is a fixed address which is given to a network device 4 when it is manufactured and an Internet Protocol address 6 is a variable address which is assigned and associated with MAC address 2. In the past, when using an ethernet network in a factory automation network, users have been plagued with the problems of managing the relationship of the MAC address 2 with the Internet Protocol (IP) address 6. Typical addressing systems assign IP addresses 6 to network devices 4 based on the network device's MAC address 2 without regard to the network device's physical location. Because every network device 4 has a different MAC address 2, when one network device 4 is unplugged from the network and another network device 4 put in its place, a subsequently connected network device in the same location as the first network device 4 will most likely not be assigned the same IP address 6 as the first. This is especially true in systems where IP addresses 6 are "leased" to a particular MAC address 2 for a particular period of time, such that even when the network device 4 is not connected to the network, its IP address 6 remains reserved. This method of assigning IP addresses is desirable where network devices move from place to place but wish to

10

15

20

-2-

maintain their original logical identity on the network or when a particular location on the network is used by many different network devices at different times, such as in an office environment.

These addressing systems fall short in a factory automation setting. Problems occur when a user installs a network device at a fixed location in a factory with the network device performing a particular function on the network, such as controlling a machine. If a problem develops with the network device, maintenance must be performed by a factory technician who is skilled in the field of repair of the machine but is not skilled in the area of networking management. If the network device must be replaced by a different network device, the machine will not operate until the new MAC address of the new device is associated with the old IP address (formerly associated with the removed device's MAC address). This is due to the fact that the machine (or other device) is configured to communicate with the IP address. A network management professional must be summoned to perform the task of associating the IP address with the new MAC address, and, as a result, the machine must left offline until a networking professional can be summoned. This loss of machine production time costs a significant loss in production and, therefore, money. This invention eliminates the need for the network management professional to be available for replacement of the network device. The present invention solves this and other problems.

### Summary Of The Invention

The present invention discloses a network switch for a computer network which receives a network message from a network device and forwards the network message to an appropriate destination. The network switch has a plurality of ports for receiving and forwarding the network

-3-

message. The network switch has a logical address server which assigns a logical address to a network device based upon the port of the network switch to which the network device is connected.

In an alternative embodiment, there is disclosed a logical address server connectable to the port of a network switch. The logical address server assigns logical addresses to network devices connected to the network switch. The logical address server assigns a logical address to a network device based upon the port of the network switch to which the network device is connected.

Also disclosed is a method of assigning a logical address to network device connected to a port of a network switch comprising the step of assigning the logical address based upon the port of the network switch to which the network device is connected and a device for performing the method.

### **Brief Description Of The Drawings**

FIG. 1 is a diagram of a system of assigning logical addresses according to the prior art.

FIG. 2 is a diagram of a system of assigning logical addresses according to an embodiment of the present invention.

FIG. 3 is a diagram of a system of assigning logical addresses according to a second embodiment of the present invention.

### **Detailed Description of the Invention**

While the invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail a preferred embodiment of the invention. It is to be understood that the present disclosure is to be considered only as an example of the principles of

-4-

the invention. This disclosure is not intended to limit the broad aspect of the invention to the illustrated embodiments. The scope of protection should only be limited by the accompanying claims.

Referring to Figure 2, there is shown a computer network switch 10 having six ports 12. It should be understood and will be readily apparent to one of ordinary skill in the art that the network switch could have any number of ports 12. Connected to three of the ports 12 are network devices 14. The network devices 14 can be any electrical device capable of communication over a computer network, such as a personal computer, a programmable logic controller or an input/output device. The network switch 10 receives a network message from any one of the network devices 14 and forwards the network message to an appropriate destination.

The appropriate destination depends on the type of network being used. For example, in an ethernet network implemented over twisted pair copper wire, the network switch could be a "smart" network switch and forward the network message to one or more network devices 14 for which the network message is intended, or it could be a "dumb" network switch and forward the message to all network devices 14. In the case of a "dumb" network switch the network devices 14 for which the network message is not intended merely ignore the network message. In the case of a token ring type network, the network switch might merely pass the network message to the next computer in the ring. All of the scenarios for an appropriate destination are well known and are readily understood by one of ordinary skill.

The network switch 10 further comprises a logical address server 18 which assigns an IP address 16 to a network device 14 based upon the port 12 of the network switch 10 to which the network device 14 is connected. In order for the logical address server 18 to know which IP address 16 to assign

each port 12, the logical address server 18 must be initially configured by a networking professional to associate each IP address 16 with each port 12.

5 In use, when one of the network devices 14 fails, a technician simply removes the defective network device 14 from the network by disconnecting it from the port 12. A new network device 14 is then placed on the network by connecting it to the port 12 from which the failed network device 14 was disconnected. Either upon connecting the new network device 14 to the network or upon the network device's 14 request, an IP address 16 is assigned by the logical address server 18 to the new network device 14 based on the  
10 port 12 of the network switch to which the device is connected. In this manner, the failed network device 14 and the new network device 14 have the same IP address 16.

Optionally, the logical address server 18 can be configurable to assign an IP address 16 based on either the port 12 of the network switch 10 or  
15 assign an IP address 16 based upon a MAC address associated with the network device 14.

The network switch 10 is preferably connected to network devices 14 by electrical wires and the network messages are preferably electrical signals. However, the present invention can be easily adapted to accept fiber optical  
20 cables to connect the network devices to the network switch which transmit light pulses as the network messages.

While the specific embodiments have been illustrated and described, numerous modifications come to mind without significantly departing from the spirit of the invention, and the scope of protection is only limited by the  
25 scope of the accompanying claims.

CLAIMS

I claim:

5 1. A network switch for a computer network which receives network messages from a network device and forwards the signal to an appropriate destination having a plurality of ports for receiving and forwarding the network message, the network switch comprising:

10 a logical address server which assigns a logical address to a network device based upon the port of the network switch to which the network device is connected.

15 2. The network switch of claim 1, wherein the logical address server assigns the logical address to a network device based upon the port of the network switch to which the device is connected for less than all of the ports of the network switch.

20 3. The network switch of claim 1, wherein the logical address server assigns the logical address to a network device based upon the port of the network switch to which the device is connected for a portion of the ports and assigns a logical address to network devices of other ports based upon the fixed address of the network device.

25 4. The network switch of claim 1, wherein the logical address server is a modified DHCP server.

5. The network switch of claim 1, wherein the logical address server is a modified BOOTP server.

-7-

6. The network switch of claim 1, wherein the network devices are connected to the network switch with electrical wires and the network messages are electrical signals.

5           7. The network switch of claim 1, wherein the network devices are connected to the network switch with fiber optic cables and the network messages are impulses of light.

10           8. A method of assigning a logical address to network device connected to a port of a network switch comprising the step of assigning the logical address based upon the port of the network switch to which the network device is connected.

15           9. The method of claim 8, wherein the logical address is assigned based upon the port of the network switch to which the network device is connected for less than all of the ports.

20           10. The method of claim 8, wherein the logical address is assigned based upon the port of the network switch to which the device is connected for portion of the ports and comprises the further step of assigning a logical address to a network device based upon a fixed address of the network device for a remaining portion of the ports.

25           11. The method of claim 8, wherein the network devices are connected to the network switch with electrical wires and the network messages are electrical signals.



-8-

12. The method of claim 8, wherein the network devices are connected to the network switch with fiber optic cables and the network messages are impulses of light.

5 13. A device for performing the method of claim 8.

14. A method of assigning a logical address to network device connected to a port of a network switch comprising the steps of attaching the network device to the network switch; requesting a logical address; and,  
10 assigning the logical address based upon the port of the network switch to which the network device is connected.

15 15. The method of claim 14, wherein the logical address is assigned based upon the port of the network switch to which the device is connected for less than all of the ports.

16. The method of claim 14, wherein the logical address is assigned based upon the port of the network switch to which the device is connected for portion of the ports and comprises the further step of assigning a logical  
20 address to a network device based upon a fixed address of the network device for a remaining portion of the ports.

17. The method of claim 14, wherein the network devices are connected to the network switch with electrical wires and the network  
25 messages are electrical signals.

18. The method of claim 14, wherein the network devices are connected to the network switch with fiber optic cables and the network messages are impulses of light.

19. A device for performing the method of claim 14.

Figure 1  
prior Art

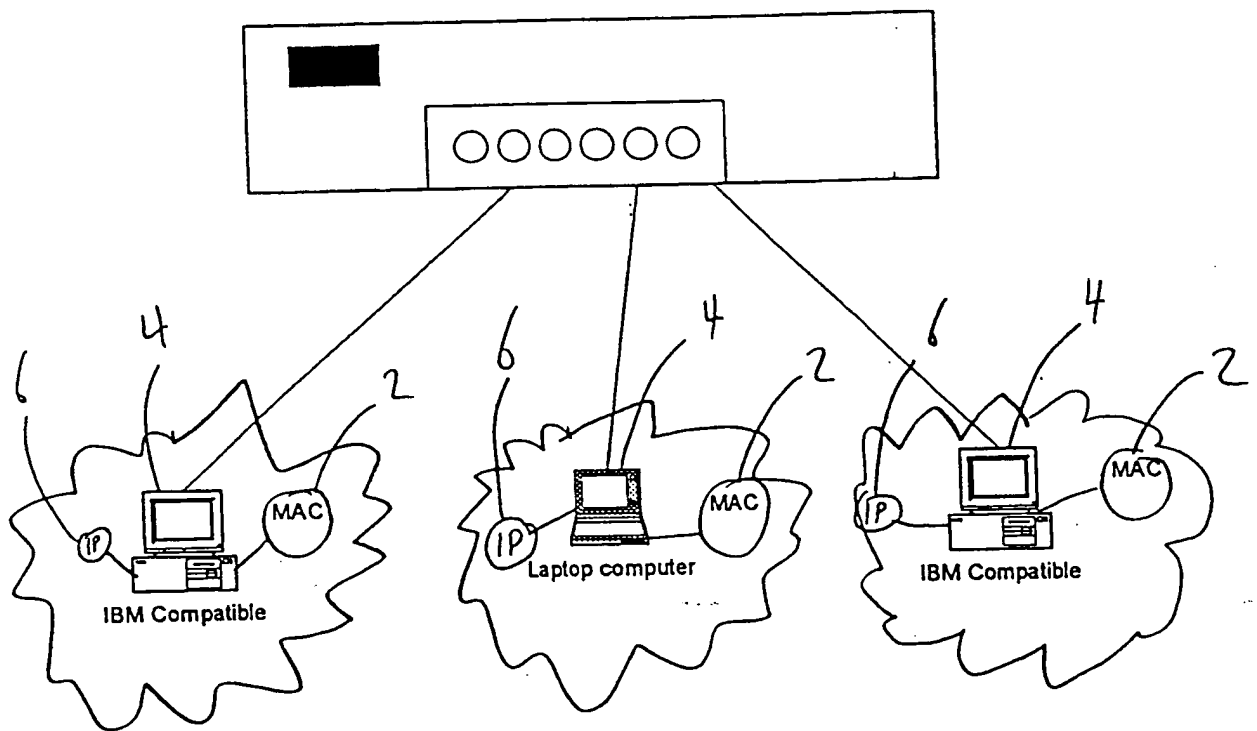
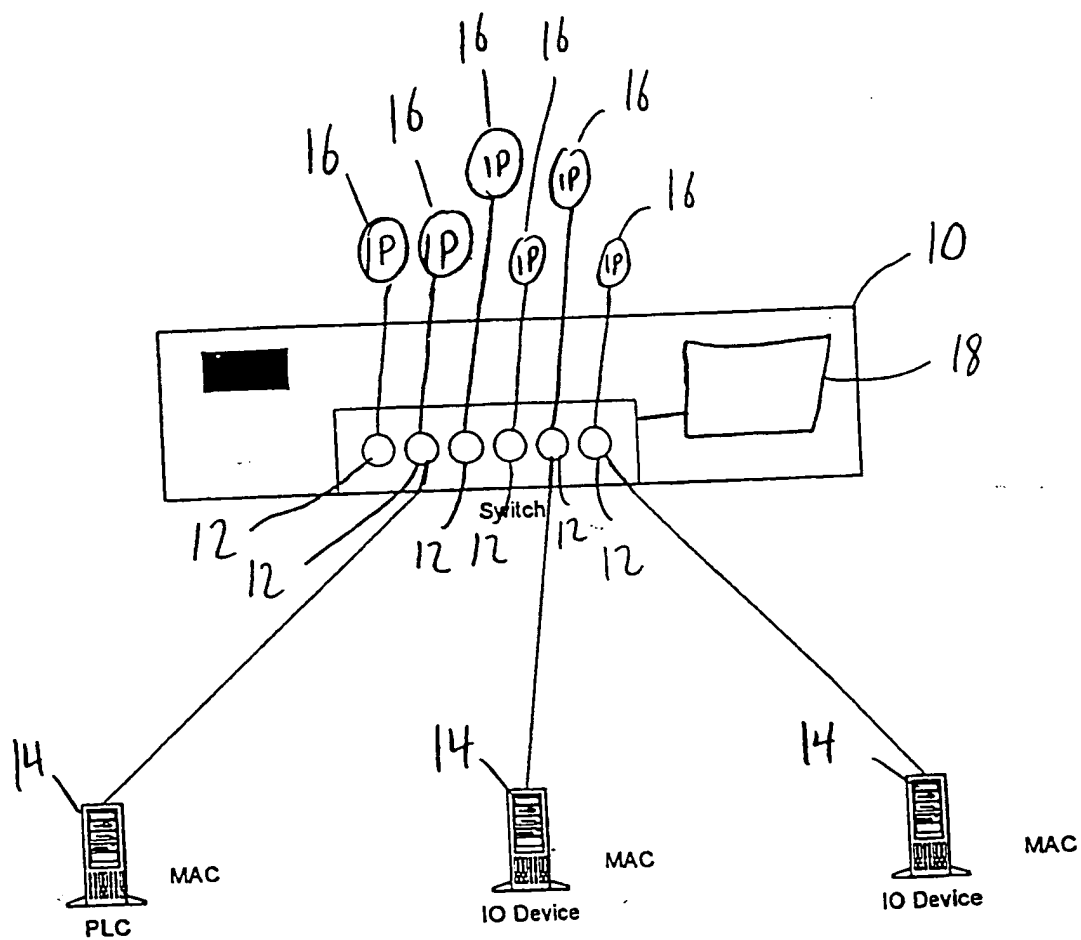


Figure 2



# INTERNATIONAL SEARCH REPORT

Inter. Jnal Application No

PCT/US 00/33188

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04L29/12 H04L12/44

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 526 489 A (NILAKANTAN CHANDRASEKHARAN ET AL) 11 June 1996 (1996-06-11) abstract column 2, line 29 - line 51 column 3, line 25 - line 29 figure 3 box136 column 6, line 19 - line 28 column 6, line 43 - line 58 column 9, line 32 - line 43 column 9, line 44 - line 46	1-19
A	EP 0 946 027 A (HEWLETT PACKARD CO) 29 September 1999 (1999-09-29) figure 6 box134 page 4, line 22 - line 26	4,5



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

### \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*G\* document member of the same patent family

Date of the actual completion of the international search

26 March 2001

Date of mailing of the international search report

02/04/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.  
Fax: (+31-70) 340-3016

Authorized officer

Peeters, D

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Interr. Appl. No.

PCT/US 00/33188

Patent document cited in search report	Publication date	Patent family member	Publication date
US 5526489 A	11-06-1996	AU 672097 B	19-09-1996
		AU 6017894 A	11-10-1994
		CA 2157193 A	29-09-1994
		EP 0689696 A	03-01-1996
		JP 8507911 T	20-08-1996
		WO 9422087 A	29-09-1994
EP 0946027 A	29-09-1999	US 6070187 A	30-05-2000
		JP 2000041069 A	08-02-2000

Figure 1  
prior Art

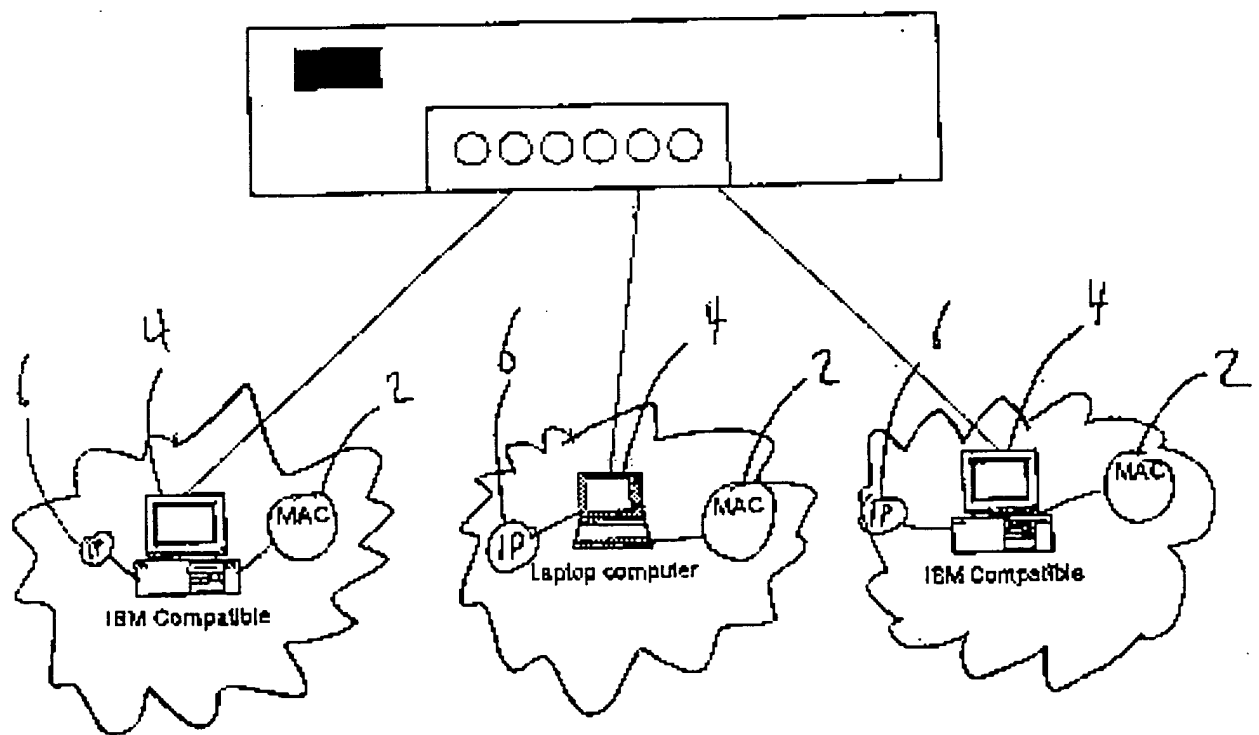
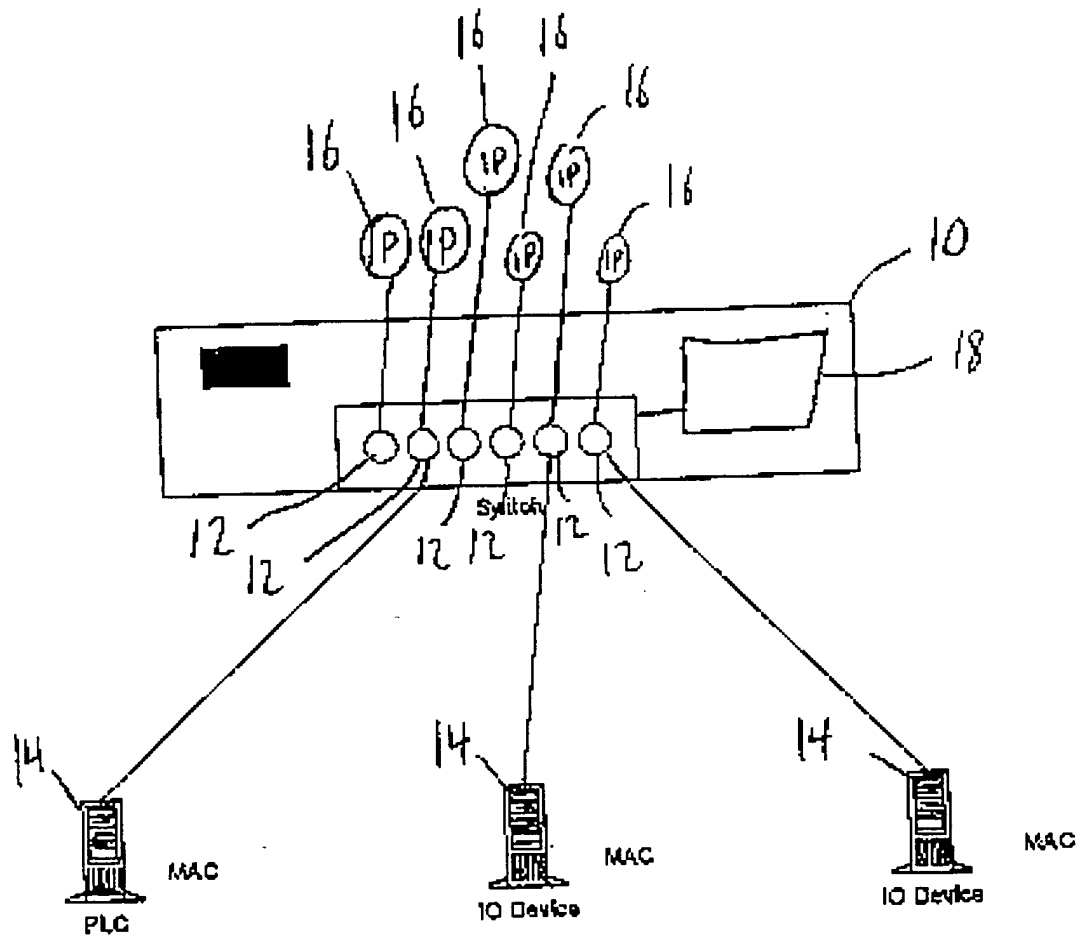


Figure 2





**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**